

Historic, Archive Document

Do not assume content reflects current scientific knowledge, policies, or practices.

18
284

~~CIRC. COPY ONLY~~

AGRICULTURAL

Research

U.S. DEPARTMENT OF AGRICULTURE

JUNE 1969

U. S. DEPT. OF AGRICULTURE
NATIONAL AGRICULTURAL LIBRARY

JUL 23 1969

CURRENT SERIAL RECORDS



AGRICULTURAL Research

June 1969/Vol. 17, No. 12

Diet and Health

Nations or individuals, we are what we eat. Good nutrition is a lifeline to sound physical, emotional, and mental health. We must be properly fed if we are to develop to the limit set by heredity.

Before this century began, USDA scientists initiated fundamental studies on the composition of food materials and their use by the body. Later, USDA began a series of surveys to estimate diet quality and developed aids to improve family diets. Although broad in scope, these efforts were and are responsive to the needs of the times.

Today, laboratory research centers on nutrients. ARS scientists are striving to determine exactly which nutrients the body needs, in what amounts, and which foods supply them. This is a formidable task, for nutrition is a young science. Major gaps exist in knowledge about the requirements for amino acids, vitamins, trace minerals, and other nutrients by various age groups, especially teenagers and senior citizens. We also need to know more about how our bodies handle fats and carbohydrates, problems complicated by genetic differences in people.

Results of laboratory research on nutrients have implications for food processing. Thus, in response to widespread dietary shortages of iron, ARS chemists recently found a way to fortify whole milk with iron compounds. Other foods will undoubtedly be similarly bolstered.

A parallel response is occurring in nutrition education. The most recent ARS food consumption survey has shed light on the national dietary situation. Information drawn from this survey and food and nutrition research provides guidelines for government agencies in establishing food policies and programs and, on the local level, helps educate families to make better food choices.

ARS scientists are stepping up their nutrition education efforts, especially on radio and TV. And they are working closely with State nutrition committees and other groups in planning action programs to remedy shortcomings revealed by the survey.

Our present knowledge of nutrition—incomplete as it is—can significantly raise the national level of well-being. But science can only point the way. It's up to each one of us to eat wisely.

CROPS

- 8 Cotton Plant Inoculation
- 12 A Grass for Transition Lawns

ENGINEERING

- 10 Tractor Traffic
- 11 Delay Sweet Cherry Harvesting

INSECTS

- 14 Gypsy Moth Rearing Made Easier

LIVESTOCK

- 3 Egg Bits Speed Virus Research
- 5 Ewe Pregnancy Test
- 14 Trichinosis Eradication Closer

MARKET QUALITY

- 6 Turkey Boning More Efficient
- 7 Beaker Cuts *Salmonella* Test Time

SOIL AND WATER

- 13 Strip Mulching

AGRISEARCH NOTES

- 15 CO₂ Bait Lures Livestock Pests
- 15 Overcoming Zinc Shortage in Pintos
- 16 Sheep Resistance to Worms
- 16 DSMA Curbs Nutsedge in Cotton
- 16 Corn Hybrids for Reduced Lodging

Editor: R. P. Kaniuka

Managing Editor: E. H. Davis

Contributors to this issue:

R. C. Bjork, J. P. Dean

P. U. Fells, D. W. Goodman

M. B. Heppner, L. W. Lindemer

W. W. Martin, M. M. Memolo

D. P. Movitz, S. A. Oring

N. E. Roberts, M. E. Vanderhoof

D. M. Webb

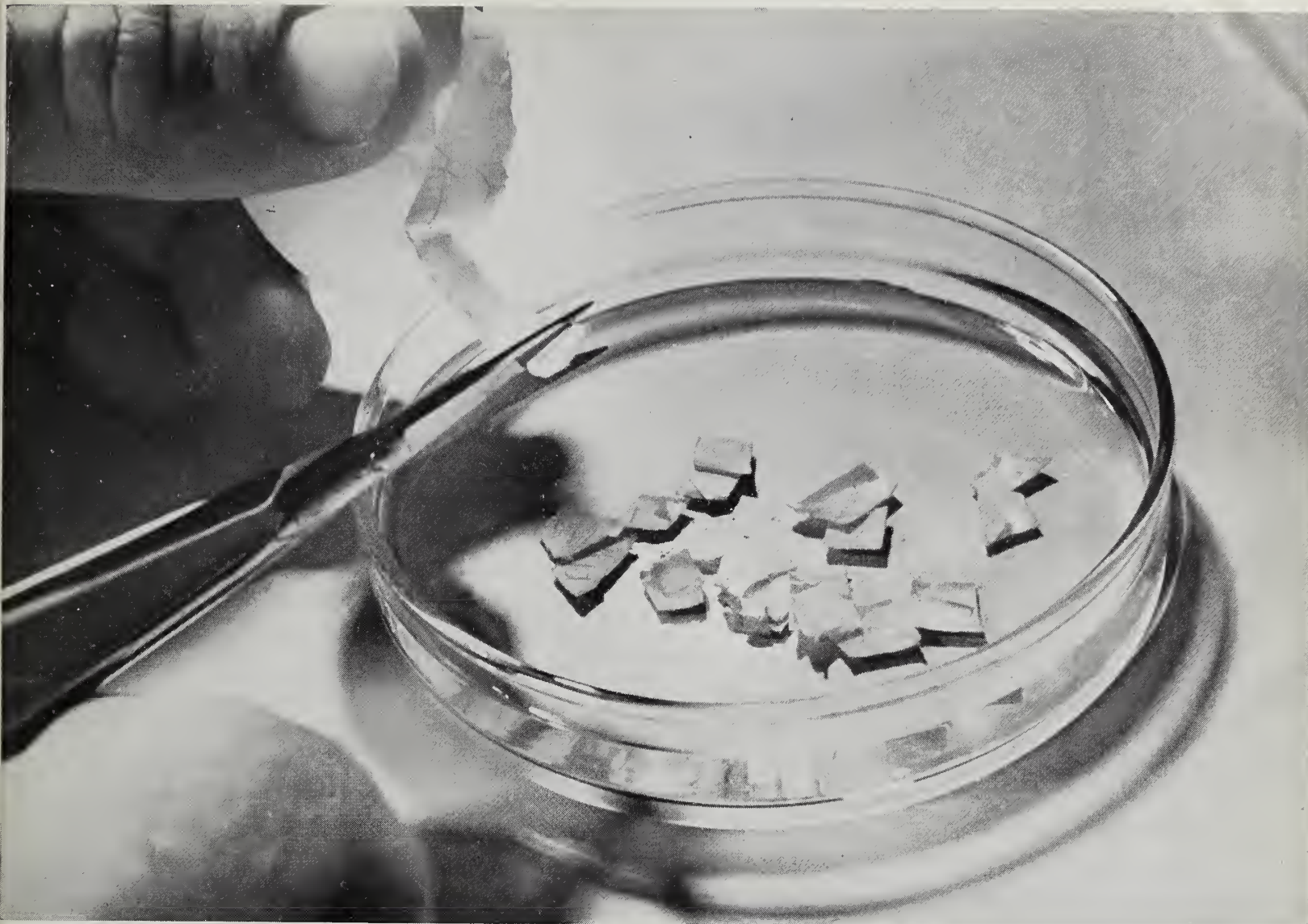
AGRICULTURAL RESEARCH is published monthly by the Agricultural Research Service (ARS), United States Department of Agriculture, Washington, D.C. 20250. Printing has been approved by the Bureau of the Budget, June 1967. Yearly subscription rate is \$1.50 in the United States and countries of the Postal Union, \$2.00 in other countries. Single copies are 15 cents each. Subscription orders should be sent to Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. Information in this periodical is public property and may be reprinted without permission. Mention of the source will be appreciated but is not required.

Clifford M. Hardin, Secretary

U.S. Department of Agriculture

G. W. Irving, Jr., Administrator

Agricultural Research Service



Bits of egg are cut and dropped into Petri dish containing medium (PN-1783).

EGG BITS/ part is better than the whole in virus research

ONE SMALL SHELL FRAGMENT, or "egg bit," aided by an artificial medium, can do the work of a whole egg in virus disease research—with less money, time, work, and space.

Eggs are used in measuring the level of antibody in blood serum. This level indicates the degree of protection furnished by vaccination or the severity of infection caused by actual disease. It is determined by the number of

viruses inactivated when serum and viruses are mixed.

Viruses must be supported by a live host during the test reaction. Conventionally, embryonated eggs filled this role. But Australian researchers discovered that embryonic membranes sticking to the inside of egg shells after an embryo is removed can act as a live host to support viruses.

ARS veterinarian C. W. Beard suc-

cessfully adapted this principle to modern laboratory procedures. Already useful for Newcastle disease, a respiratory ailment of chickens that is Beard's specialty, the modified technique can also serve in research on viruses causing influenza in animals and man.

Beard's experiments at the Southeast Poultry Research Laboratory, Athens, Ga., proved that valid antibody determinations could be made with egg bits just 1 centimeter square—small enough to fit into the wells of a standard disposable laboratory test tray. This adaptation has several advantages.

First, fewer eggs are needed. One egg cut into bits supplies the same amount of data once requiring 50 whole eggs.

Second, less serum is needed. Beard found that the egg-bit test worked better when the blood serum was diluted instead of the virus before

the two materials were combined for testing.

Third, the egg-bit test saves work. Cutting the bits and preparing the trays take only 5 minutes per egg. In addition, the new procedure allows a technician to handle 12 serum samples in a single tray. The one tray can be used to dilute the serum about to be tested, maintain egg bits during incubation, and test for the presence of virus at the conclusion of the procedure.

Further work is saved when working with viruses that do not kill embryos during conventional testing. Previously, fluid from whole eggs had to be drawn out and transferred to test tubes or trays for final determination of the antibody level. This transfer is eliminated with the egg-bit technique because the test material is already in the trays.

Fourth, the egg-bit test saves valuable space. Beard showed that six to

eight trays, each holding 96 bits, could be stacked into a single package. A dozen eggs cut into bits fitting in six plastic trays provide as much information as 576 eggs incubated whole.

Fifth, the egg-bit test improves versatility. Bits from a single egg are more uniform than 50 separate eggs, allowing virus tests free of host-to-host differences. Further, bits are readily accessible throughout the whole testing process. Scientists can snip off parts of bits for special side procedures without interfering with the basic test. Side procedures like these are difficult with whole eggs.

Beard is also applying the egg-bit test to evaluating chicken families for genetic resistance to Newcastle disease. He can run a statistically valid virus test series on bits from a single selected egg. He says such a test series would be impossible to do with an embryonated whole egg. ■



Above: Egg bits are placed in trays containing medium (PN-1784). Right: They will then be incubated and sampled. By conventional methods, a third of the eggs stacked behind Beard would be needed for the same number of tests made in six trays of egg bits from two eggs (PN-1785).





Left: Lindahl holds amplifier and inserts probe as ewe is held on her back (ST-4607-8). Above: The probe with embedded transducer (ST-4607-2).

Ewe Pregnancy Test: adapted for small flocks

PREGNANCY DETECTION in ewes with a new application of the ultrasound technique may prove ideal for small flock owners.

The new technique is fast and accurate, says its developer, ARS sheep nutritionist I. L. Lindahl, Beltsville, Md. It does not require time-consuming preparation of the animal and will not harm the ewe or fetus.

Many methods of pregnancy detection in sheep have been tried, but none has proven satisfactory except the ultrasound technique. Rectal palpation, used to detect pregnancy in cows, cannot be used because sheep are too small.

In the past, amplitude-depth ultrasound has been about 90 percent accurate in detecting pregnancy in ewes (AGR. RES. Aug., 1966, p. 4). To examine the ewe, a transducer is placed in front of the udder. Sounds emitted by the transducer show up on a screen as patterns of light, which vary for pregnant and open ewes.

Lindahl's new method uses a Doppler transducer embedded in the end

of a probe. The probe is inserted into the rectum of the ewe as she is held on her back, thus duplicating electronically the rectal palpation done with cows.

As the uterus of the inverted sheep lies directly over the inserted probe, the Doppler bounces ultrasound pulses, too high for the human ear, off tissues of the fetus and ewe. The frequency of ultrasound changes as it strikes moving organs and body fluids. The deflected sound is audible and can be recorded on tape. Lindahl is able to distinguish between the sounds deflected by fetal heart beat, fetal body movement, and fetal pulse as well as those deflected by uterine, venous, and arterial blood flow.

Lindahl can detect pregnancy as early as the 40th day after conception, but he examines most of the sheep from the 50th to 60th day, when the results are the most reliable.

The price of the Doppler transducer is \$900, but a less expensive one is being tested. Even \$900 would not be too expensive, Lindahl says, if the cost

were shared by several owners, and the savings were considered.

Guaranteed pregnancy, or lack of it, means dollars to the flock owner. Lindahl can examine 60 ewes per hour with three assistants at a cost of 33 cents per ewe for labor. Carryover of barren ewes costs the grower \$2 for every breeding ewe.

Lindahl says if sheepmen can detect pregnancy accurately, they can run 5 to 15 percent more ewes during the breeding season. They can then separate barren ewes and sell them instead of wasting money and effort on supplemental feeding, housing, and special prelambling attention. Guaranteed pregnancy will also mean more money for ewes sold as breeding stock and greater success in conducting out-of-season breeding tests.

Detection of multiple births may be one of the greatest benefits of pregnancy detection, because ewes require additional nutrition when carrying more than one lamb. If twins or triplets are detected, better care of the ewe means more lambs saved. ■



Many procedures at processing plants have been streamlined in recent years, but little improvement has been made in the boning system—the most expensive part of the entire operation.

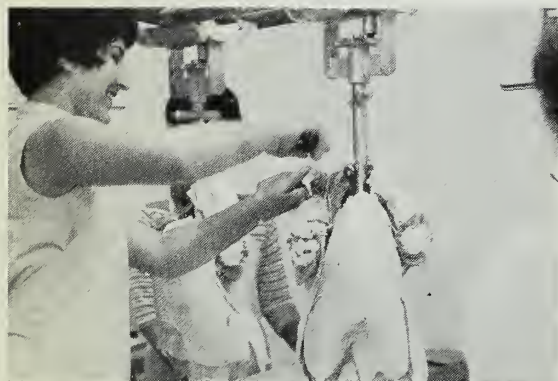
ARS studies showed that workers on monorail boning lines used excessive time, effort, and attention in performing their tasks. The major cause of inefficiency was the type of shackle used to suspend turkeys from the conveyor. The shackle allowed a bird to swing freely as it moved along the processing line. Workers had to reach for the bird, turn it into position for cutting, then hold it with one hand as the other hand did the cutting. Sometimes, the worker would have to move from his station and follow the bird along the line to make required cuts. This not only reduced cutting accuracy but often involved walking 2 or 3 miles extra a day.

New equipment, based on ARS recommendations and requirements, was designed and tested under a research contract by the Gordon Johnson Co., Kansas City, Mo. The University of California cooperated in the project by determining yields of prime meat produced.

A rigid-type shackle was provided to hold the birds securely, and camming devices to position birds automatically for cutting were added along the line. These changes enable workers to use both hands freely, making cutting faster, easier, and more precise.

Besides the equipment changes, plans were also developed to balance workloads more evenly along the line and to train workers to make full use of the new operation sequence and equipment.

Field tests of an experimental single-line mechanized turkey boning operation in a commercial plant showed that productivity increased 32 to 45 percent per worker. And yields of prime meat cuts were increased 2 percent. ■



Top: Worker loosens skin from turkey on new shackle apparatus. Skin is cut to remain in a large piece for encasing roasts and rolls (BN-33596). **Left:** The first cut to remove thigh meat (BN-33599). **Right:** Near the end of the operation, flank membrane is severed (BN-32595).

turkey boning

Improvements speed the system

AN IMPROVED turkey boning system can increase yields and reduce operating costs of individual processing plants by \$22,000 to \$44,000 a year, depending on volume and work schedule.

Some 300 million pounds of turkey is processed annually for such specialty items as turkey logs and roasts.

Banwart Beaker

cuts salmonella test time

RESEARCHERS HAVE TAKEN a giant step toward developing a faster, simpler food inspection procedure to help protect consumers from bacterial diseases caused by *Salmonella*.

The Department requires that processors of feeds and foods containing poultry or egg test their products for *Salmonella*. Using the conventional testing method, it can take up to a week to clear a product shipment. This time means inventory buildups, shipping delays, and high labor costs—all of which can translate into higher prices for the consumer.

Two years ago ARS microbiologist G. J. Banwart, Beltsville, Md., developed a technique for getting the job

done 2 days sooner (AGR. RES., Aug. 1967, p. 3). Several firms have been testing this method.

Now Banwart has devised a method that could enable processors to clear 95 to 99 percent of their shipments in a little over 24 hours.

The secret of this newest technique is a three-armed glass beaker Banwart designed.

Into two of the U-shaped arms Banwart pours semisolid agar media responsive either to mannitol fermentation or hydrogen-sulfide production—indicators of the presence of *Salmonella*-type organisms. Into the third arm goes one of several experimental media he is exploring in an effort to discover a medium that reacts only with *Salmonella*.

After the media solidify in the base of the U, Banwart adds brain heart infusion (BHI) broth to the top of the agar surface in the arms. The beaker chamber itself contains the food or feed sample in a lactose or selenite-cystine broth.

The prepared flask is incubated for

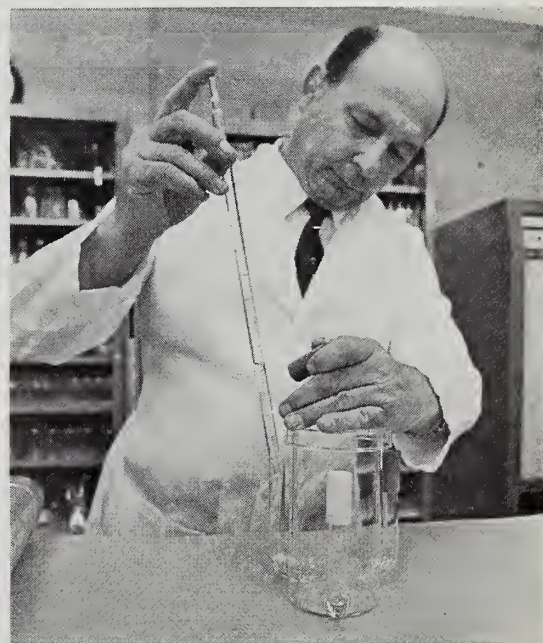
24 hours. If no reaction occurs in the semisolid media in the U tubes, the sample is *Salmonella*-free.

If, however, one of the media turns color and the BHI is cloudy, a sample of the BHI is tested with an anti-serum that will agglutinate the *Salmonella* after an hour in a warm water bath. Samples showing no agglutination can also be considered *Salmonella*-free.

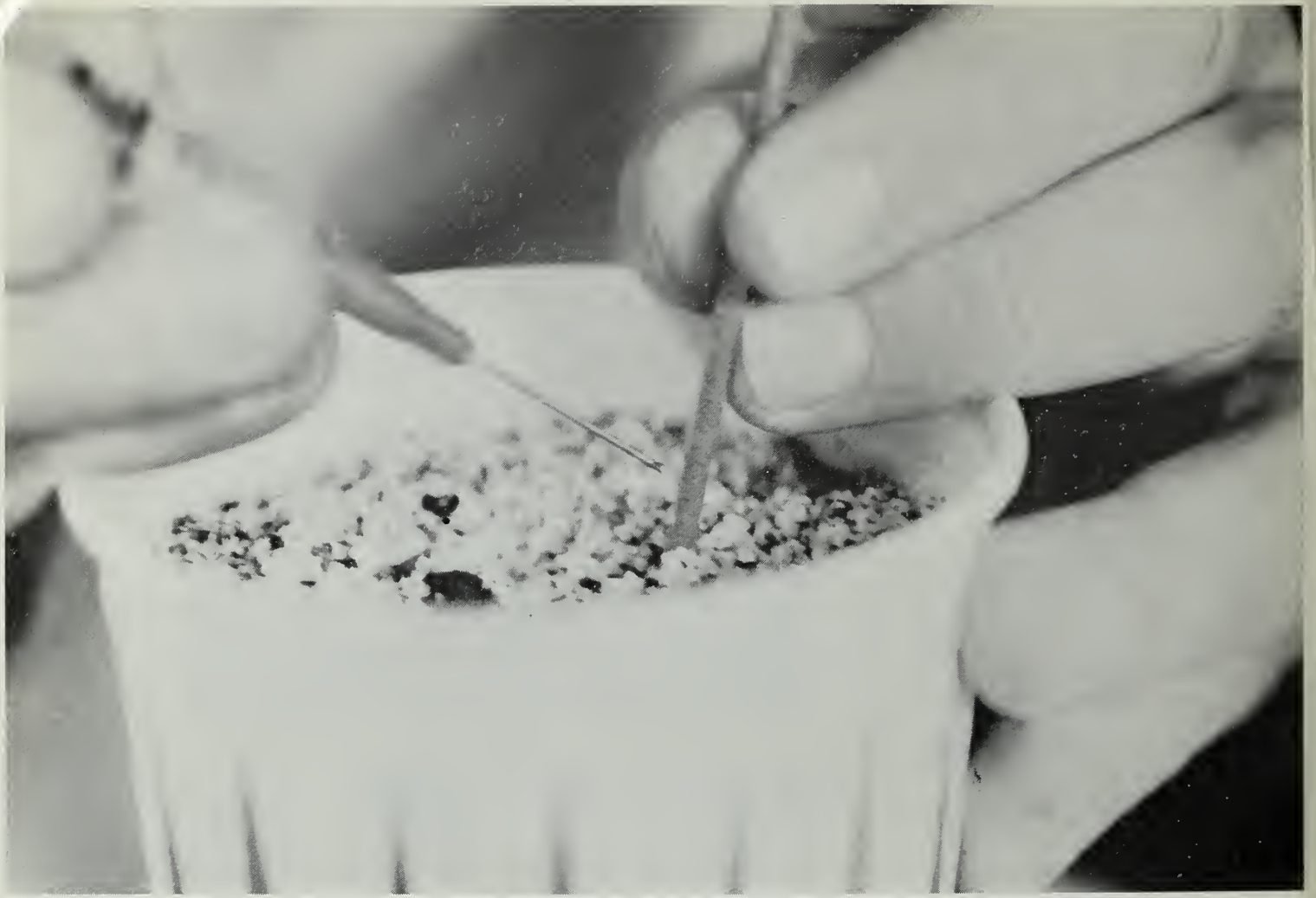
Only those samples, perhaps 1 to 5 percent, that react positively to the agglutination test need be streaked on agar surfaces and incubated for another 24 hours to isolate organisms for further tests to confirm the presence of *Salmonella*.

Having three rather than one or two test media—as with other *Salmonella* tests—gives better assurance of detecting *Salmonella*, no matter how low its concentration in the sample.

This new testing procedure has been used successfully with many types of samples, such as cake mixes, dried eggs, pot pies, dry milk, and livestock feeds. ■



Left: Banwart and his beaker which will be commercially manufactured as the Banwart flask. Nutrient broth is in chamber; U-shaped tubes each contain different medium (ST-4823-16). **Above:** Banwart pipets BHI out of medium in side arm (ST-4823-19).



Inoculations Check Cotton

CROSS-PROTECTION inoculation may mean the beginning of the end of verticillium wilt, the scourge of upland cotton.

Verticillium wilt is difficult to control and has caused losses of \$50 million or more annually. It affects every cotton-producing State. The disease is mild in the southeastern States, mild to severe in the Upper Mississippi Delta, and severe in most parts of western Oklahoma, West Texas and the plains area of Texas, New Mexico, Arizona, and California.

The inoculation technique, previously developed in ARS research, was recently tested in the field for the first time by ARS geneticist J. R. Barrow. He inoculated test cotton plants with a mild isolate of live *Verticillium albo-*

atrum. The technique protected about 45 percent of a susceptible cotton strain from later infection and completely protected two tolerant strains. The experiments were conducted in cooperation with the New Mexico Agricultural Experiment Station at Las Cruces.

In the tests, tolerant cotton strains Acala 9519 and Acala 1479 and a susceptible strain, Acala 227, were planted in a field severely infested with the wilt organism. When the plants reached the eight to 12 true leaf stage, some of each strain were inoculated by hand using a stem puncture method. Others were untreated to serve as a control.

Twelve days after inoculation, symptoms began appearing in the

treated plants, and in 24 days all of them were chlorotic and dwarfed while less than 1 percent of the check plants showed any effects. The treated plants remained visibly dwarfed the entire season, but tended to recover from the chlorosis after 50 days. At 50 days, susceptible control plants showed severe symptoms of natural infection and, a month later, had dead terminals and were defoliated.

Dwarfing in the protected plants was not a problem since it presented no harvesting difficulties nor were the number of bolls per plant significantly reduced.

The studies show that inoculation with mild isolates stimulates defense mechanisms in plants and imparts partial or complete resistance to wilt

Left: Cotton plant is inoculated with milk isolate of the Verticillium albo-atrum fungus (PN-1791).



Disease

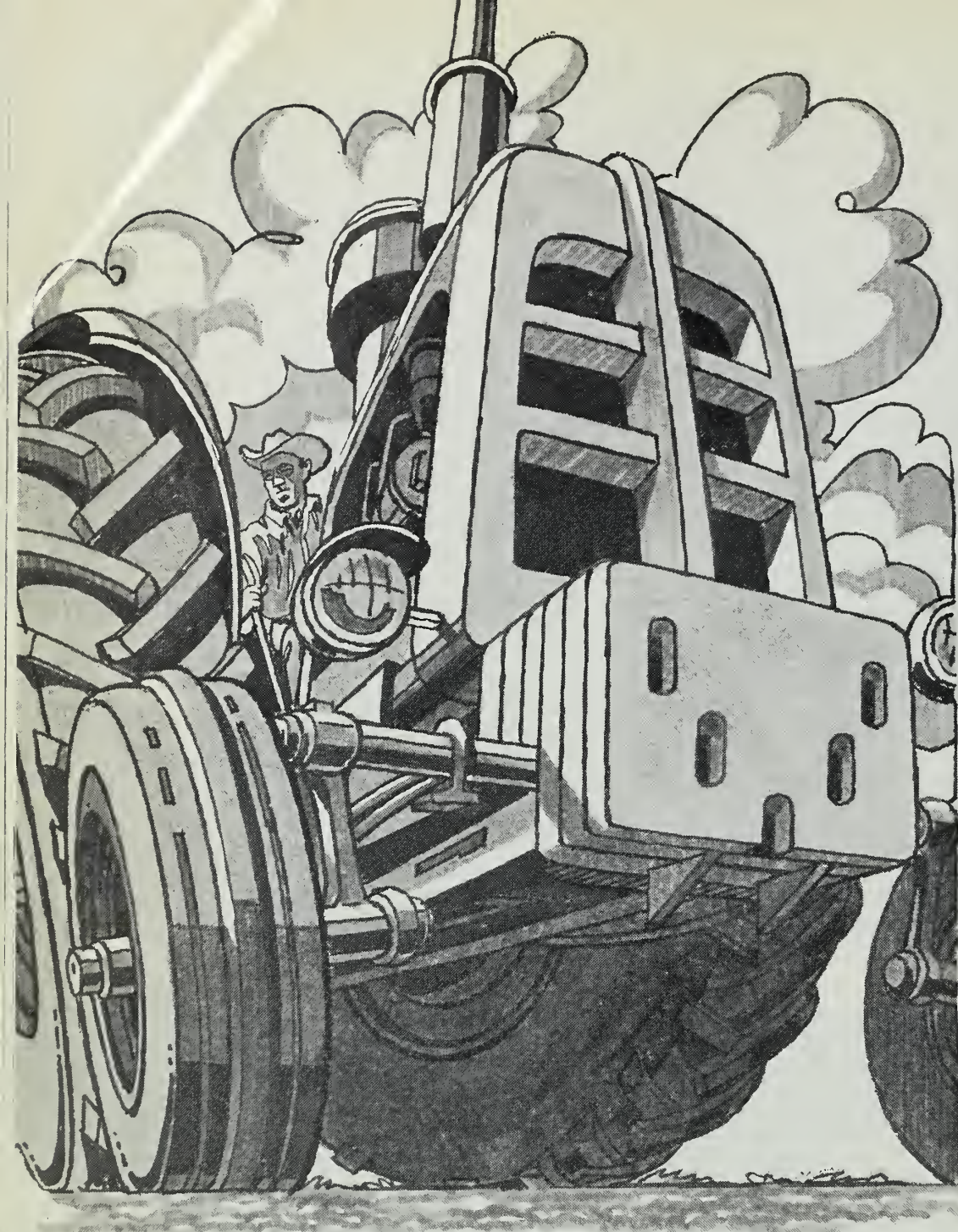
after infection, depending on the genetic characteristics of the cotton strains. It is possible that continued treatments may gradually reduce the fungal content of plant material returned to the soil to a point where the disease can more easily be controlled or even eradicated.

Barrow suggests that while this experiment shows promise in protecting cotton from verticillium wilt, it is perhaps even more important to future studies of disease resistance through plant mechanisms.

Continuing research will deal with the use of heat-killed inoculum, chemical inoculums that induce plant response, and the development of improved and more rapid application techniques. ■



Top left: Barrow examines protection obtained by using killed spores of the wilt organism. He will field-test killed spores this summer. (ST-4911-8). Top right: Inoculated plant displays wilt symptoms. Resistance shows with time (ST-4911-1). Above: 5-week-old seedlings were inoculated at 3 weeks; at 4, they received a challenge inoculation; at 7, they are read for degree of protection (ST-4911-4).



TRACTOR TRAFFIC

LARGE URBAN SPRAWLS and old MacDonald's farm have a lot in common these days—they both have traffic problems.

On the farm, it isn't the noise, the number of vehicles, the screeching of tires, or the crash of fenders. Rather, it's the increasing weight of the tractor and its many trips across the fields.

Evidence shows that heavy tractor traffic compacts the soil, inhibits root growth, and reduces yields.

To avoid these problems, agricultural engineers are seeking ways to

seed without mechanical soil preparation or to at least reduce traffic by proper equipment control.

The most common system for planting row crops in this country is to plow with a moldboard plow, disk harrow two or more times, and plant. During the harrowing operations, the harrow and the wheels of the tractor recompact the soil without regard to the location of the rows. Often rows are planted directly over wheel tracks. After the crop is planted, sprayed for weed and insect control, cultivated,

and harvested, as much as 70 percent of the soil surface is often compressed by traffic.

A 3-year study at Auburn, Ala., by agricultural engineer A. W. Cooper and soil scientist A. C. Trowse, Jr., both of ARS, and agricultural engineer W. T. Dumas of Auburn University pointed out the seriousness of soil compaction.

In the fall, a test plot was tilled to a depth of 18 inches and bedded. Areas where the wheels ran were untilled, but the soil was tilled in every other interrow space. In the spring, cotton was planted and later compared to cotton on adjacent plots where the entire surface was plowed 6 inches deep and disk harrowed.

Roots penetrated farther in the deep-tilled plots, and the yield was greater by about 400 pounds of seed cotton.

Some considerations that agricultural engineers at Auburn keep in mind when making recommendations for designing and using farm equipment are:

- Wheeled equipment should have rear wheels that move in the same path as the front wheels;
- The width of the wheel path, the weight of the equipment, and the number of passes should be minimized;
- The area treated by the operation should be maximized;
- All units should follow the same path throughout the season;
- Fixed travel paths should be used year after year and not plowed.

Cooper says that if traffic can be controlled, seeding without other mechanical preparation can become a reality in some soil types.

The advent of automatic guidance systems will hasten the day when it will be possible to limit tracks through the field to little more than the width of the wheel. ■

SWEET CHERRY GROWERS

...hold back the shakers

GROWERS of sweet cherries are discovering that mechanical tree shakers can harvest this fruit about as well as they harvest red tart cherries. But the growers might increase their profits substantially by not using the machines on the first day cherries are mature enough to be shaken down from the trees.

In fact, 5 to 7 days later, when the cherries are larger and easier to shake down, the tonnage harvested might be increased 25 percent or more. This means a grower averaging 100 tons early in the season would have a 125-ton crop about a week later, worth (at \$300 a ton) an estimated \$7,500 more.

This is the conclusion of a study made last harvesting season by ARS agricultural engineers J. H. Levin and H. P. Gaston, stationed at Michigan State University, and chemist R. T. Whittenberger of the ARS Eastern utilization research laboratory in Philadelphia. They worked in the Lake Leelanau area of northwestern Mich-

igan, where commercial harvesting was done between July 14 and 20.

Twice a week from July 8 to 28, researchers counted, weighed, and analyzed the cherries as they developed on a few test trees, including Schmidts, Windsors, and Napoleons, and they determined the force required to pull cherries from the branch.

As the rest of the orchard was mechanically harvested, the scientists evaluated the crop for quality. They also hand-picked cherries the shakers failed to harvest and arrived at a percentage-recovery figure to express the machine's efficiency.

Studies of the maturing fruit on the test trees indicated that when commercial harvesting began, the cherries had not yet reached their peak in size, weight, or soluble solids content. Also, the pull force required to dislodge them, which should not be more than 500 grams for maximum recovery with minimum bruising, was too high.

It was about 1,000 grams on July 8, and still above 600 grams the first day of harvesting. It did not drop below 500 grams until about the end of the commercial picking season.

As a result, the shakers worked at less than peak efficiency. For example, they removed only 83 percent of the harvestable Windsor cherries on July 16. On the 26th, an experimental mechanical harvesting achieved 97 percent recovery. Although the differences were not so great for the other varieties, the pattern was similar.

The ARS researchers admit that some risk is involved in delaying sweet cherry harvesting. The later the harvesting season, the greater chance that fruit will be damaged by rot, scars, bruising, and cracking. Such damage was not much of a problem last year in Michigan, however.

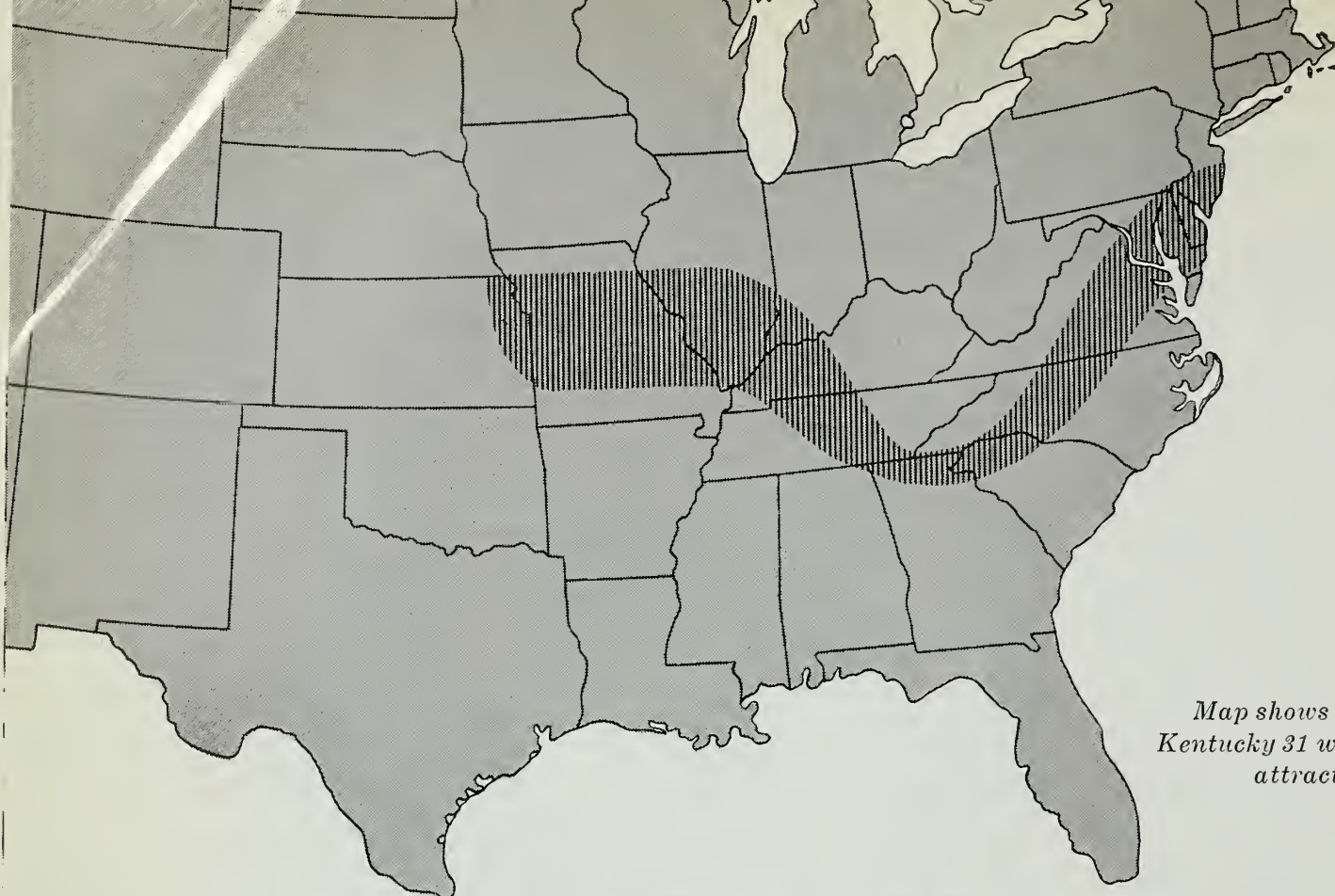
Anyway, the scientists believe the prospect of a 25-percent tonnage increase should be great enough to make the gamble worthwhile. ■

Hand-pickers gather fruit that machine failed to remove from trees (PN-1786).



for transition area lawns

kentucky
31



Map shows transition zone where Kentucky 31 would provide a hardy, attractive lawn (PN-1787).

KENTUCKY 31, a variety of tall fescue (*Festuca arundinacea*), may solve lawn problems in the eastern areas of the United States not suitable to either northern or southern grasses.

Such lawn grasses as Kentucky bluegrass and bentgrass are adapted to the cool-season area in the North, and zoysia and bermudagrass grow well in the warm-season area in the South. However, none of them fare especially well in the zone that separates the two major areas. This zone, called the transition region, covers an area extending roughly from Washington, D.C., to northeastern Kansas.

In research to find a grass suitable for lawns in the problem area, ARS agronomists F. V. Juska, A. A. Hanson, and A. W. Hovin found that Kentucky 31 was well adapted for the region and that it would provide hardy, manageable, and attractive lawn turf.

Though tall fescue had been used on athletic fields, roadsides, airfields, and other areas where tough turf is desirable, it was considered too coarse and bunchy for lawns. And previous research had been directed primarily

toward the use of tall fescue for forage.

In studies spanning 9 years, the scientists tested two seed mixtures, three cutting heights, and time, source, and rate of nitrogen for their effects on turf quality. They obtained the best results with Kentucky 31, seeded at about 6 to 8 pounds per 1,000 square feet, fertilized as indicated by grass color throughout the growing season with ammonium nitrate at 6 pounds per 1,000 square feet, and mowed to a height of about 2 inches. The experiments also showed that a pure seeding of Kentucky 31 tended to prevent undesirable clumping that developed in tall fescue-bluegrass mixtures.

Generally, Kentucky 31 is well adapted to the transition zone for several reasons. It has good persistence under mowing, it has satisfactory winter color, is shade tolerant, grows well in heavy soils, will tolerate wet or dry conditions and either acid or alkaline soils.

It is especially suited for large, expansive lawn areas and parks where a uniform wear-resistant cover is more important than very fine texture. ■

strip mulching

may prove more effective

Thin mulch covers entire area in left plot; suggested system is on right— heavy mulch on rear and bare ground in front. Dikes surround each plot to keep water from running off (PN-1788).

STRIPS of heavy mulch on part of a fallow field—with the rest left bare—may sometimes conserve more soil water than a thinner mulch spread over the entire field surface.

Laboratory experiments by ARS soil scientists J. J. Bond and W. O. Willis suggest such a conservation practice might be valuable on the Northern Great Plains—after mid-summer of the fallow year. If their current tests under field conditions prove equally promising, this research may lead to more effective ways of storing water in the soil between crops when land is alternately fallowed and seeded to spring wheat.

The laboratory studies at Mandan, N. Dak., measured the effects of eight amounts of straw mulch on soil drying for 40 days after mulched soil columns were uniformly wetted. The experiments were conducted in a controlled environment, and water loss was determined by periodically weighing the soil columns.

These studies showed how the equivalent of 0 to 6,000 pounds of straw per acre influenced the three stages of soil drying previously identified by ARS scientists:

Stage 1: Rapid loss of water by evaporation immediately after wetting.

Stage 2: Rapidly decreasing evaporation.

Stage 3: Very slow but relatively constant evaporation.

Bond and Willis found that the amount of mulch affected evaporation mainly during stage 1. Two effects were noted:

Each addition of 500 pounds of straw through the 2,000-pound rate



(full surface cover) reduced stage 1 evaporation by about 12 percent; still higher rates produced progressively smaller reductions.

Increasing the amount of residue lengthened stage 1. For example, stage 1 lasted about 6 days with 500 pounds of straw, 9 days with 2,000 pounds, 17 days with 4,000 pounds, and 23 days with 6,000 pounds.

In addition, the scientists noted that the total amount of water lost from the soil by the end of the test (cumulative evaporation) was nearly equal for all treatments. Under field conditions, cumulative evaporation from mulched and bare soil is similarly about equal if drying continues through stage 3.

Projecting their results to a field situation, Bond and Willis point out that stage 1 of the drying cycle (when surface mulches are more effective) is of short duration on the Great Plains. Much of the water loss, however, occurs during stage 1.

They postulate that using available crop residues for covering the entire field surface will produce the greatest reduction in evaporation until about

July 1. About 80 percent of precipitation stored in the soil during the 21-month fallow period with alternate fallow-spring wheat occurs by July.

However, rains are more widely spaced after July 1, and surface residues will have deteriorated by tillage and weathering. At this time, Bond and Willis suggest a potential advantage for concentrating available residues in narrow strips within a field, perhaps covering a half or a fourth of the total area.

On these protected areas, stage 1 of the drying cycle will be prolonged after the rain that does fall. Since heavier mulching rates are more effective during stage 1, the net result should be a saving of more soil water than with a lighter mulch over the entire surface. And during the inevitable extended dry periods when stages 2 and 3 are in effect, evaporation would not be appreciably different from the mulched and bare-soil areas.

Further research will determine whether such a system of mulch management is practical. ■

GYPSY MOTH

Lab rearing made easier

THREE NEW TOOLS will help wage the battle against gypsy moths—pests that have been stripping leaves from forests in the Northeast for 100 years.

These devices, developed by ARS entomologist J. P. Secrest and technician J. G. Tardif, permit the quick and easy cleaning and counting of gypsy moth eggs.

Secrest and Tardif use the equipment in producing gypsy moths in the ARS Plant Pest Control Laboratory at Otis Air Force Base, Mass. The work is part of the sterile-male release and parasite rearing and distribution programs in the Northeast. Last summer, the laboratory reared and sterilized about 80,000 male gypsy moths and released them during an 8- to 10-week period in Pennsylvania, New York, and Massachusetts. Matings with sterile moths are infertile.

The entomologists also mass-produced an average of 500,000 gypsy moths each year for the past 4 years to

find effective chemical and biological controls. Five promising insect parasites of the gypsy moth are presently being investigated.

Rearing gypsy moths in the laboratory is a time-consuming process. The eggs must first be separated from a gluelike material and mat of hair the female moth deposits on each mass of 400 to 800 eggs. The hairs irritate human skin, and the work is tedious. Once the eggs are separated from the hair, they must be individually counted so researchers will know the percent of hatch.

The egg cleaner developed by Secrest and Tardif uses a screened funnel and vacuum cleaner to remove the hair mat. This device improves personnel comfort and reduces the time needed to clean 500,000 to 600,000 eggs from 5 hours to 1.

One of the counting devices they developed uses ordinary masking tape and a petri dish drilled full of tiny holes—each 0.59 inch across. The



Eggs are mechanically swept into tiny holes of mechanical counter where they then drop into a petri dish (PN-1789).

operator puts a group of eggs into the dish; they roll into the holes and stick to the tape underneath. When the dish is turned over, eggs stay on the tape.

Extremely useful when examining large numbers of eggs under a dissecting microscope, this manual tape counter also serves as an accurate emergence record, since the eggshells stay on the tape after the larvae have escaped.

For a large number of eggs, a more elaborate but similar mechanical egg counter was designed which takes less time and reduces counting errors as well as operator fatigue. ■

Trichinosis test: a step toward eradication

AN EFFICIENT and effective method of detecting trichinae in hogs slaughtered under commercial meat-packing conditions has been tested and proved. In 8 months of operation, the pilot-project examined over 482,000 hogs and identified 42 or 0.009 percent as trichinous.

The new method of detecting the parasites of hogs and man—called the pooled-sample digestion technique—was developed at Iowa State University, Ames. It was proven by USDA and industry cooperators at a meat-packing plant in Iowa.

For the technique, hog carcasses are divided into lots of 20 immediately after slaughter and marked with a lot

number. A 5-gram portion of the diaphragm is removed from each carcass in a lot and taken to a laboratory in the packing plant. Here, the 20 portions are mixed, ground, digested in a pepsin-acid solution, and examined microscopically for trichinae. Thus, 20 hogs can be tested at once and an entire day's kill examined without interfering with the slaughter process.

If a single trichina is found, the 20-carcass lot is retained and each carcass is examined by the same procedure. Infected carcasses are processed to kill trichinae by prescribed meat inspection methods, while noninfected carcasses are released for normal processing. Infected carcasses are traced

to the farm of origin so the disease can be eradicated at its source.

The pilot-project has demonstrated that this method could be the means for eradicating trichinae in the Nation's swine. Further advancement toward eradication depends upon support of the swine industry and others favoring elimination of trichinosis.

For the present, consumers should continue to protect themselves against trichinosis. Raw pork, bacon, fresh sausage, and other unprocessed pork products should never be tasted before cooking. Heating pork to an internal temperature of at least 137° F. assures the destruction of any trichinae that may be present. ■

AGRISEARCH NOTES

Overcoming Zinc Shortage in Pintos

When preventative measures have been overlooked, zinc deficiency of pinto beans in southern Idaho can be corrected with foliar zinc sprays up to 45 days after planting.

Zinc deficiency delays maturity and cuts down on yields. It can be prevented by mixing powdered zinc compounds into the soil before planting.

But using a Pinto 114 bean variety, ARS chemist J. W. Brown of the Snake River Conservation Research Center, Kimberly, Idaho, applied zinc sprays 14, 21, 31, 45, or 52 days after planting. Idaho's Agricultural Experiment Station cooperated.

Zinc deficiency, indicated by light green leaves, was apparent soon after planting, but plants greened within 3 or 4 days after the spray application.

Beans treated at the three earliest dates (14, 21, 31 days) matured after 105 days. Those treated at the later dates (45 and 52 days) matured 10 days later. Beans on the no-zinc control plots, although not fully mature, were harvested 115 days after planting because of a predicted freeze.

Yields of marketable beans averaged 1,967 pounds per acre from the zinc treated 45-day-and-under plots. Control plots averaged 1,505 pounds per acre. Differences in yield were not significant among bean plots sprayed 14, 21, 31, or 45 days after planting.

CO₂ Bait Lures Livestock Pests

Deer flies, horse flies, and related species of these livestock pests are attracted to carbon dioxide, indicating potential value for this gas in traps for insect surveys or possibly even for control.

In a series of twenty 24-hour tests in late summer, ARS entomologist R. H. Roberts at Stoneville, Miss., caught 1,200 flies in a trap in which about 2 quarts of carbon dioxide was released per minute. Only about 800 flies were caught in an unbaited trap. Thirteen species of horse and deer flies were among the insects captured, but bees and other beneficial insects were not attracted to the gas.

Carbon dioxide had been tested as a bait for these flies by other investigators, but the gas was derived from dry ice. Consequently, the amount of gas baiting the traps varied with the surrounding temperatures and the thickness of insulation around the dry ice. This probably influenced fly responses.

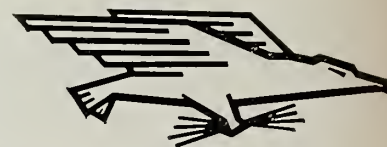
Roberts maintained a more consistent amount of carbon dioxide in the trap by using bottled gas released through a flowmeter. Although captures decreased as the volume of carbon dioxide was reduced, other factors such as temperature and humidity varied during the tests, Roberts said, and may have affected capture rate.

Releases of 1 to 4 pints of carbon dioxide per minute will be tested again this summer with added controls over variable weather conditions.

The Mississippi Agricultural Experiment Station is cooperating.

Roberts sets up tentlike Malaise trap. Carbon dioxide is piped from tank into trap to lure flies which are collected in jar at top of tent (PN-1790).





POSTAGE & FEES PAID
United States Department of Agriculture

AGRISEARCH NOTES

Sheep Resistance to Worms

Sheep apparently develop an immunity to threadnecked strongyle worms by their second grazing season, but they're just as susceptible to large stomach worms as first-season lambs.

Zoologist H. H. Vegors, working with scientists at the U.S. Meat Animal Research Center, Clay Center, Nebr., noted that lambs had almost equal infections with threadnecked strongyles (*Nematodirus* spp.) as with stomach worms (*Haemonchus contortus*). But sheep in their second and later seasons, while harboring many stomach worms, had relatively light threadnecked strongyle infections.

Vegors says these findings point up the fact that producers need to give special care to worm control with drugs and management for lambs the first year of life; older animals require special attention to stomach worm infections.

DSMA Curbs Nutsedge in Cotton

Nutsedge, a weed that causes significant yield and quality losses in cotton, can be controlled effectively with the herbicide DSMA (disodium methanearsonate).

Nutsedge is one of the most difficult weeds to suppress in cotton grown on 1¼ million acres in the Southeast.

Midsouth, Far Western, and Trans-Pecos regions.

ARS agronomist J. H. Miller, working in cooperation with the University of California, found that two post-emergence applications of DSMA applied about 15 to 20 days apart were an effective control. When the sprays were directed at the base and stems of plants before the cotton bloomed, they were equal or superior to topical (overall) sprays in effectiveness and affected cotton less. Topical sprays sometimes decrease cotton yields, leave herbicide residues in the cottonseed, or both.

DSMA is registered for use on cotton except in California.

Corn Hybrids for Reduced Lodging

Efforts to halt the severe lodging of corn in Tennessee are producing encouraging results.

A recent ARS-Tennessee Agricultural Experiment Station study shows that hybrids can be developed that will utilize heavy applications of fertilizer without lodging.

Corn lodging is generally the result of present-day high production standards which require closer spacing and higher fertility. The plants grow taller and less sturdy, breaking more readily. Part of the breakage is due to stalks dying prematurely, particularly when not enough potassium is available.

The Tennessee research, conducted

at Crossville, involved four inbreds, six possible single crosses from them, and three permutations of hybrids Dixie 29 and Tennessee 604 seeded 13,000 plants per acre. Varying amounts of potassium fertilizer were applied to plots that were uniformly low in potash.

The inbreds differed in their ability to absorb potassium at low-soil levels. They likewise differed in their response to added potassium and this response was transmitted to their progeny. Inbreds and hybrids that responded poorly to added potassium usually had the highest yields on low-potassium soils. Other hybrids responded better to large amounts of potassium.

In general, maintaining an adequate level of potassium in the soil greatly reduced lodging in many hybrids. The test results should help breeders select for hybrids that will perform well under varying conditions of fertility.

CAUTION: In using pesticides discussed in this publication, follow directions and heed precautions on pesticide labels. Be particularly



careful where there is danger to wildlife or possible contamination of water supplies.

